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1986-1987 FIELD STUDIES ON PINNIPEDS AT SAN CLEMENTE ISLAND

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Charles W. Oliver

ADMINISTRATIVE REPORT LJ-91-25

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1986-1987 FIELD STUDIES ON PINNIPEDS AT SAN CLEMENTE ISLAND

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INTRODUCTION

Pinniped research has been conducted at San Clemente Island by Southwest Fisheries Science Center (SWFSC) personnel since July of 1981. San Clemente Island is one of four islands in the Southern California Bight (SCB) where California sea lion (Zalophus californianus) and northern elephant seal (Mirounga angustirostris) rookeries exist (Seagars et al., 1985). Harbor seals (Phoca vitulina richardsi) also breed at San Clemente Island and other islands within the SCB (Stewart and Yochem, 1985). Research conducted at San Clemente Island has been directed toward monitoring island population trends of these three species of pinnipeds.

In this report, I present results obtained by myself and other researchers at the SWFSC on seasonal distribution and numbers of pinnipeds, California sea lion food habits, salvage of dead marine mammals, data obtained from tagged sea lions and elephant seals, disturbance factors, and cetacean sightings for the period January, 1986 through December, 1987. This report is one in a series of reports on SWFSC research conducted at San Clemente Island (Oliver and Lowry, 1987, Oliver et al., 1988, Wexler and Oliver, 1988, Lowry et al., 1990, Oliver and Wexler, 1991).

STUDY AREA

San Clemente Island is the third largest and southernmost United States-owned island in the SCB. It is administered by the Department of the Navy, Naval Air Station at North Island, San Diego, California, and is used primarily for military operations. The principal study area is located on the southwest side of San Clemente Island from Seal Cove Point to an area we named "the Shack", a linear distance of approximately 7.5 km (Figure 1). I divided this area into three distinct sub-areas: 1) north of Mail Point, 2) Mail Point, and 3) south of Mail Point (Figure 2). Data were also collected, but less often, between the Shack and Lost Point, a linear distance of approximately 3.5 km. This area is adjacent and to the south of the principal study area (Figure 1). No aerial surveys were made around the island during during 1986-1987 as we had done during 1984-1985 to note pinniped distribution outside the study area. We made a single excursion outside the study area to the Northwest Harbor Islet (Figure 1) on June 12, 1986.

METHODS

Counts and Distribution of Pinnipeds

We conducted seven ground surveys within the principal study area during 1986-1987. We censused sea lions and elephant seals over a two-day period. Counts were made from Seal Cove Point to Mail Point on one day, and continued from Mail Point to Arch Rock the next day. We were able to obtain complete counts of sea lions and elephant seals during those trips which included observations from atop Mail Point. From there animals could be surveyed below the Flat Area and on the southwest, northwest and north sides of Mail Point. If we did not ascend Mail Point, counts were considered incomplete, although we made efforts to estimate numbers of animals at these areas from other locations. We censused pinnipeds using 9x30 or 10x50 binoculars while remaining concealed behind terrain features. We were able to approach most animals to within 50 meters, and often much closer, without disturbing them. Animals in some areas, primarily the islands below Seal Cove Point and offshore of Tiki Head Beach (Figure 2), were censused at much greater distances. Data were recorded on field maps converted from aerial photographs of the coastline as we have previously described (Oliver et al., 1988). We made counts of harbor seals at the Shack, a haulout approximately 1 km south of Arch Rock (Figure 2). These counts were usually performed two days after sea lions and elephant seals had been censused and were obtained from a distance of approximately 100 meters using binoculars.

We categorized as many animals as possible according to age and sex. Sea lions and harbor seals were counted as either pups-of-the-year or non-pups. Pups of 1985 were animals born during the summer of 1985 and counted as 1985-pups through June of 1986. Thereafter, 1985-cohort pups were included in counts as non-pups. We counted 1986-cohort pups beginning with our observations of live pups in June, 1986. We used the same criteria during 1987 for counting 1986 and 1987-cohort pups. Non-pups consisted of adults, subadult males, juveniles and yearlings. Northern elephant seals were classified as adults, subadults, yearlings, weaned pups or unweaned pups. Complete counts within the principal study area were obtained during the March, July, and September of 1986, and March, July, and October of 1987.

California Sea Lion Food Habits Study

Scats were collected at all three sea lion haulout areas: 1) north of Mail Point; 2) Mail Point; and 3) south of Mail Point (Figure 2). South of Mail Point collections accounted for most of our samples. We collected samples after the animals had left their haulouts. While we had collected both fresh and dry scats in previous years, and collected as many as 100 scats during a trip, we altered our collection criteria to obtain 30-50 fresh or

semi-fresh scats per trip beginning in 1986. This change resulted from an analysis of the 1981-1985 SCI scats which was conducted to determine the minimum number of scats required to detect a "change in diet" of California sea lions (Goodman, 1987). Because we collected only fresh or semi-fresh scats, we ceased clearing areas of all scats during a trip. Scats were individually bagged and labeled, and subsequently stored in a freezer upon our return from the island. Laboratory procedures and analyses of the scat samples are described in Lowry et al. (1990).

Salvage of Dead Marine Mammals

When physically possible, we salvaged dead marine mammals at all haul-out areas and during beach surveys from Lost Point to the Shack during 1986. We placed less emphasis on salvage beginning in 1987. Because salvage efforts were generally conducted while censusing an area and looking for tagged animals and scats, we were only able to salvage animals from areas where animals were not hauled out. To reduce the amount of disturbance to animals, we generally did not examine dead animals in most of the Mail Point area, nor on the beaches below the Uppers to south of Mail Point (Figure 2). We noted all dead animals at these locations, whether or not we salvaged the carcass. All salvaged marine mammal carcasses were marked with red surveyor's tape so that carcasses would not be mistaken for recent strandings during subsequent trips. We continued to collect canine teeth for age and sex determination. All specimen parts were stored at the SWFSC. Pinniped salvage data were recorded on a pinniped life history data form and entered into the SWFC database PINNLIFE.DAT for all data collected during 1986. Because of personnel changes, specimen data collected during 1987 have not been entered into this database.

Tagging and Resights of Tagged Pinnipeds

We tagged northern elephant seals under the authority of Marine Mammal Protection Act Permit 404 in March of both years at Mail Point. Pups were tagged with white Reise tags in the inter-digit webbing closest to the outer edge of each rear flipper. Non-pups were tagged, without chemical or physical restraint, while animals were resting and generally resulted in only a single tag being placed on a rear flipper. Data on the age, sex, location, tag number and color, and physical condition of each animal were recorded in addition to tooth eruption and molt condition for weaned pups. We tagged California sea lions under the authority of Marine Mammal Protection Act Permit 347 in September of 1986, approximately two to three months after the onset of the breeding season. We did not tag California sea lions in 1987. All tagging occurred in the Mail Point area where pups were most accessible and abundant. Personnel stalked small groups or herded larger groups against the sides of rocky cliffs at the North Face and Big Pool areas of Mail Point (Oliver et al., 1988). Animals were

then captured with hoop nets. After capture, pups were weighed, sexed, measured, and tagged. Tags were placed on the inside rear edge of each fore-flipper close to the body. Data on the sex, location, tag number and color, pup weight, and general physical condition were recorded for each animal. We recorded tag information on coding forms and entered these data into the SWFSC database STAGDB.DAT (Wexler, 1985).

We obtained the tag numbers of previously tagged pinnipeds during each census using 9x30 binoculars, 10x50 binoculars, and 20x45 spotting scopes. Tag number, color, condition of tag, location of tag (left, right or both flippers) and animal age class, condition, association and behavior were recorded, and subsequently coded and entered into the SWFSC database STAGDB.DAT for both 1986 and 1987.

RESULTS and DISCUSSION

Counts and Distribution of Pinnipeds

The numbers of California sea lion pups and non-pups we censused during 1986-1987 are presented for each sub-area (NMP, MP, SMP) within the principal study area in Table 1 and Figures 3-4. Our greatest pup count for 1986 was obtained during July 25-28 (718 pups) and during July 31-August 3 for 1987 (782 pups). Pups were most abundant in the Mail Point area during each of our trips in both years (42-65%), while the SMP area accounted for 16-50%, and the NMP area 8-25% (Table 1, Figure 3). Mail Point produced the greatest number of pups and the highest ratio of pups to total number of animals during July in both 1986 and 1987. During the 1986 breeding season, we again noted an increase in the number of animals in all three sub-areas (1,824 sea lions). The June-July increases in the MP and NMP areas were primarily comprised of adult females and newborn pups, while the much greater increases in the SMP area resulted from greater numbers of juveniles and SAMs (Figures 3-4). During the 1987 breeding season, we again observed an increase in the total number of animals within the study area (1,816 sea lions), but noted a decrease in the number of animals in the SMP area. This decrease was offset by the much greater increase of animals in the MP area in 1987 compared with 1986 (Table 1, Figure 3). While there were more pups in the SMP area than in the NMP area in both years, the NMP area produced a higher ratio of pup-to-total-animal counts as we have reported in prior years (Figure 3).

Although the NMP area is larger than either the MP or SMP areas, we have only observed animals at Seal Cove Point and between the "Small Cliffs" and Tiki Head Bridge Beach (Figure 2) within the NMP area. We looked for animals outside the study area on only one occasion. On June 12, 1986, we counted 48 California sea lions (1 pup, 47 non-pups) at the Northwest Harbor Islet (Figure 1) during a single excursion to this area.

Very few northern elephant seals were seen at San Clemente island during our seven trips to the island in 1986-1987 (Table 1). However, our trips did not coincide with either the breeding season for northern elephant seals (January-February), nor the spring molting period (April-May). There were 23 animals at Mail Point during our March 28-31, 1986 census, and 31 animals during October 16-18, 1987. A molted, weaned male pup was seen at Mail Point during the March 28-31, 1986 trip, and an unmolted and unweaned female pup was seen during the March 17-18, 1987 trip. Both pups were probably born on San Clemente Island. On June 12, 1986, a single northern elephant seal was seen at the Northwest Harbor Islet (Figure 1) during a single excursion to this area. The age-class distribution of elephant seals is presented in Table 3.

We observed harbor seals within our study area at the Shack (Figure 2) during four of the seven trips (Table 1). The most animals we observed totaled 26 during the March 1986 census, including 8 harbor seal pups. Eighteen seals (3 pups) were seen during March of 1987 at the Shack. On June 12, 1986, three harbor seals were seen at the Northwest Harbor Islet (Figure 1) during a single excursion to this area.

California Sea Lion Food Habits Study

We collected 267 fresh or semi-fresh scats, and 6 spewings from California sea lions during 1986 and 1987 (Table 3). Eight samples from the 138 scats and 3 spewings collected during 1986 were omitted from prey analysis due to procedural errors during laboratory processing. Laboratory procedures are described in Lowry et al., (1990) and all identifications and species percentages were made by Mark Lowry (SWFSC). Those positively identified otoliths, beaks, and other prey remains which were obtained from 130 scats and spewings collected during 1986 are included in the prey list shown in Table 4.

Lowry et al., (1990) describe in detail the results obtained from an analysis of scats collected at San Clemente Island during 1981-1986. Using their definition of "commonly occurring prey" as those prey with PFO's of 10% or more, we found four prey to commonly occur (PFO$\geq$ 10%) in the 130 scats and spewings analyzed for 1986. These are: 1) northern anchovy (Engraulis mordax), 78.5%; 2) Pacific whiting (Merluccius productus), 32.3%; 3) Market squid (Loligo opalescens), 25.4%; and, 4) rockfish (Sebastes spp.), 10.8% (Table 4). Although the percentages were different and there were two additional species that met the "commonly occurred criteria" during 1985, the rank of these four prey were the same in both 1985 (Oliver and Wexler, 1991) and 1986. Results from scats and spewings collected during 1987 will be presented in a separate report.

Salvage of Dead Marine Mammals

California sea lions were the only stranded pinniped observed and examined during the year (Table 5, Appendix 1). Because of the reduced effort we placed on salvage beginning in 1987, these data should not be compared with previous salvage data at San Clemente Island when we were more vigorous in our efforts to examine specimens and collect samples. We did not find any premature pups in either 1986 nor 1987, which may be further indication of reduced neonatal pup mortality during 1984-1987 compared to 1982 or 1983 when we salvaged 6-13 premature pups each year. A beaked whale (Ziphius spp.) was salvaged during March 1986 outside the study area (Appendix 1).

Tagging and Resights of Tagged Pinnipeds

Five northern elephant seals were either single or double-tagged with white Reise tag numbers 658-662 during March, 1986 (Appendix 2). The ages of tagged elephant seals included one pup born at San Clemente Island and 4 yearlings. A pup and 2 yearling seals were tagged during March, 1987 with white Reise tag numbers 772-774.

The general physical condition of sea lion pups tagged in September, 1986 was rated as good with only five of the 107 pups examined having been rated fair, and none as poor. Two pups appeared to be blind in one eye. No open lesions were observed around the genital and anal areas, or on the ventral surfaces of the rear flippers, as were observed during 1984 (Wexler and Oliver, 1988) and 1985 (Oliver and Wexler, 1991). These lesions may have been associated with the San Miguel Island Virus (Smith et al., 1977).

We sexed, weighed, measured, and double-tagged 107 California sea lion pups of the 1986 cohort with white Reise tags numbered between 664 and 771 (Appendix 3). Tag number 666 had been used during 1985. Approximately seventeen percent of the pups counted during the September trip were tagged (107/638=16.8%). Sex ratios and mean weights for 107 pups, and mean lengths and girths for 97 tagged pups are listed in Table 6. Data for individual animals are shown in Appendix 3. The sex ratio of 107 pups which we sexed and weighed did not deviate significantly ($X^2_{0.05,1} = 0.234$) from the expected 1:1 ratio (Table 6). We found the sample variances for male and female pup weights to be equal ($F_{0.05(1),51,56} = 1.112$) and used a means test which allowed for equal sample variances. The mean weight of 51 male pups (23.2 kg) was significantly greater than the mean weight of 56 female pups (19.6 kg) in September, 1986 ($t_{0.05(1),105} = 7.014$).

Both male and female mean weights obtained in 1986 were greater

than we reported for the 1983 and 1984 cohorts (Wexler and Oliver, 1988). A two-way ANOVA for male and female weights obtained during 1982-1986 indicate significant differences for both year ($F_{0.05(4,623)} = 137.053$, $P<0.001$) and sex ($F_{0.05(1,623)} = 118.089$, $P<0.001$) treatments. Because male weights were significantly greater than female weights during 1982-1985 (Oliver and Wexler, 1991) and again in 1986, I performed a one-way ANOVA on male and female weights separately, and used the Newman-Keuls multiple range test (Zar, 1974) to test for significant differences between years.

Mean male weights were significantly different for all year combinations except 1982 versus 1985 ($q_{0.05}$). Male weights in 1982, 1985, and 1986 were significantly greater than in both 1983 and 1984, and the mean weight for 1984 was significantly smaller than 1983. The mean male weight obtained during 1986 was significantly greater than weights we obtained for either 1982 and 1985, and represents the highest average male weight measured at San Clemente Island for the period 1982-1986. Mean female weights were significantly different for all year combinations except 1982 versus 1985, 1982 versus 1986, and 1983 versus 1984. ($q_{0.05}$). Mean female weights in 1983 and 1984 were not significantly different, while female weights in 1982, 1985, and 1986 were significantly greater than in both 1983 and 1984. The mean female weight obtained during 1986 was significantly greater than weights we obtained for either 1982 and 1985, and represents the highest average female weight measured at San Clemente Island for the period 1982-1986. We did not capture and tag California sea lion pups during 1987.

We found the sample variances for male and female pup lengths obtained during September, 1986 to equal ($F_{0.05(1),45,52} = 1.112$) and used a means test which allowed for equal sample variances. The mean length of 45 male pups (100.0 cm) was significantly greater than the mean length of 52 female pups (94.8 cm) in September, 1986 ($t_{0.05(1),97}=5.845$). We also found the sample variances for male and female pup girths to be equal ($F_{0.05(1),45,52} = 1.400$) and used a means test which allowed for equal sample variances. The mean girth of 45 male pups (68.9 cm) was significantly greater than the mean girth of 52 female pups (65.2 cm) in September, 1986 ($t_{0.05(1),97} = 4.847$).

We recorded data on sightings of California sea lions and northern elephant seals which had previously been tagged at San Clemente Island using white Reise or roto tags. These data were collected during each trip and the total number of unique tag numbers resighted for each trip is shown in Table 7. The tag numbers from 80 California sea lions, which had previously been tagged at San Clemente Island during 1981-1986, were obtained

during 1986, although some of these were multiple sightings of the same animal. One of these 80 tag resights (# 278) was found not associated with an animal, while the remainder were from live animals. We were unable to obtain the tag numbers for 36 white-tagged California sea lions. One tagged animal from the 1981-1982 cohorts was identified, and six from the 1983 cohort. We have not received any reports of animals tagged at San Clemente Island having been observed elsewhere during 1986.

We observed 10 live California sea lions which bore colored tags indicating they had previously been tagged somewhere other than San Clemente Island (Table 8). Nine of these 10 live animals bore red tags indicating they had been tagged at San Nicolas Island. A single animal bore a blue tag indicating it had been tagged at Santa Barbara Island. I also found a detached radio transmitter at Mail Point on September 14, 1986 which had previously been placed on a California sea lion at San Nicolas Island (Daryl Boness pers. comm.). A northern elephant seal was seen on October 16, 1987 at Mail Point, and bore red a Reise tag on its right rear flipper (tag number not obtained) indicating it had been tagged at San Nicolas Island (Table 8).

Disturbance Factors

We continued to observe evidence of potential and actual disturbance to pinnipeds within our study area on some, but not all, of our trips to the island. Past observations and discussions with island personnel indicate the following activities commonly occur: 1) naval and marine personnel observing animals at the rookery and haulouts, 2) military aircraft flying over these areas at low altitudes, and 3) commercial and sport fishing vessels operating within 50-100 meters of rookery areas. A Navy jet buzzed Mail Point at less than 200 feet on March 29, 1986, which alerted the animals but did not cause them to enter the water. On four of the seven trips, we observed abalone, lobster, SCUBA diving, and sportfishing vessels operating within as little as 10 meters of hauled-out animals, which alerted the animals but did not cause them to enter the water. During the October 1987 trip, we counted seven lobster boats, and one sea urchin vessel operating at Mail Point. During our July 1987 trip, we noted that two new bridges had been constructed along the west shoreline road, within a few hundred meters of haulouts, and that a large brush fire had occurred at the Mail Point rookery.

Cetaceans

No dead cetaceans were salvaged within the study area at San Clemente Island during 1986-1987. A single beaked whale (Ziphius spp.) was salvaged, outside the study area, during March 1986 at the west end of the runway (Appendix 1). We did not observed any gray whales within approximately one nautical mile or less of

Mail Point during 1986 or 1987 as we have in other years. No other observations of cetaceans were made within, or offshore, of the study area.

Other observations

We noted an unusually large number of brown pelicans atop Mail Point on August 1, 1987 (419 birds). We also observed a few entanglements of pinnipeds with monofilamemt gillnet. A yearling California sea lion was seen during June 1986, another during September 1986, and a juvenile during March 1987. Two California sea lion juveniles and a single northern elephant seal were seen during October 1987. All of these entanglements were within the study area and involved live animals with monofilamemt netting material.

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References

Goodman, D. 1987. Comments on the sea lion food-habits data: scat contents in collections from San Clemente Island. Southwest Fisheries Center, Admin. Rep. No. LJ-87-07C, La Jolla, California. 13p.

Lowry, M.S., C.W. Oliver, C. Macky, and J.B. Wexler. 1990. Food habits of California sea lions, Zalophus californianus, at San Clemente Island, California, 1981-86. U.S. Fish Bull. 88:509-521.

Oliver, C.W. and M.S. Lowry. 1987. Pinniped studies conducted between August, 1981 and December, 1982 at San Clemente Island, California. Southwest Fisheries Center, Admin. Rep. No. LJ-87-23, La Jolla, California. 47p.

Oliver, C.W., M.S. Lowry, and L.M. Ferm. 1988. Pinniped studies conducted at San Clemente Island, California during 1983. Southwest Fisheries Center, Admin. Rep. No. LJ-88-08, La Jolla, California. 46p.

Oliver, C.W. and J.B. Wexler. 1991. 1985 field studies on

pinnipeds at San Clemente Island. Southwest Fisheries Center, Admin. Rep. No. LJ-91-24, La Jolla, California. 31p.

Seagars, D.J., D.P. DeMaster, and R.L. DeLong. 1985. A survey of historic rookery sites for California and northern sea lions in the Southern California Bight. Southwest Fisheries Center, Admin. Rep. No. LJ-85-13, La Jolla, CA. 61p.

Smith, A.W., C.M. Prato and D.E. Skilling. 1977. Characterization of two new serotypes of San Miguel sea lion virus. Intervirology 8: 30-36.

Stewart, B.S. and P.K. Yochem. 1985. Aerial surveys of pinniped populations at the Channel Islands National Park and National Marine Sanctuary: 1984-1985. Southwest Fisheries Center, Admin. Rep. No. LJ-85-27, La Jolla, CA. 32p.

Wexler, J.B. 1985. Documentation for a pinniped tag and tag resight database. Southwest Fisheries Center, Admin. Rep. No. LJ-85-23, La Jolla, CA. 34p.

Wexler, J.B. and C.W. Oliver. 1988. Pinniped research conducted at San Clemente Island during 1984. Southwest Fisheries Center, Admin. Rep. No. LJ-88-16, La Jolla, California. 53p.

Zar, J. H. 1974. Biostatistical Analysis. Prentice-Hall, Englewood Cliffs, New Jersey. 620p.

Table 1. Numbers and distribution of pinnipeds within the study area between "The Shack" and Seal Cove Point at San Clemente Island, by data collection period, during 1986 and 1987.

Trip Period Date	Location[1]	CALIFORNIA SEA LION 1985 Pups	1986 Pups	1986 Non-pup	Total Number	NORTHERN ELEPHANT SEAL 1986 Pups	1986 Non-pup	HARBOR SEAL 1986 Pups	1986 Non-pup
March 28-31, 1986	SMP	121	0	197	318	0	0	8	26
	MP	182	0	321	503	1	23	0	0
	NMP	62	0	127	189	0	0	0	0
	Totals	365	0	645	1010	1	23	8	26
June 12-13,[3] 1986	SMP	-	38	791	829	0	0	5	14
	MP[2]	-	154	346	500	0	0	0	0
	NMP	-	46	134	180	0	0	0	0
	Totals	-	238	1271	1509	0	0	5	14
July 25-28, 1986	SMP	-	235	651	886	0	0	0	0
	MP	-	366	306	672	0	1	0	0
	NMP	-	117	149	266	0	0	0	0
	Totals	-	718	1106	1824	0	1	0	0
September 12-15, 1986	SMP	-	153	199	352	0	0	-No Count-	
	MP	-	381	295	676	0	2	0	0
	NMP	-	104	77	181	0	0	0	0
	Totals	-	638	571	1209	0	2	0	0

[1] SMP - "The Shack" to Mail Point (3.0 km of coastline).
MP - Mail Point area (0.5 km of coastline).
NMP - Mail Point to Seal Cove Point (4.0 km of coastline).

[2] Incomplete count for area or trip.

[3] - A count at the Northwest Harbor Islet yielded 48 California sea lions (1 pup); 1 northern elephant seal non-pup; and 3 harbor seal non-pups. These were not included in the table.

Table 1. continued.

Trip Period Date	Location[1]	CALIFORNIA SEA LION 1986 Pups	1987 Pups	1987 Non-pup	Total Number	NORTHERN ELEPHANT SEAL 1987 Pups	1987 Non-pup	HARBOR SEAL 1987 Pups	1987 Non-pup
March 17-18, 1987	SMP	199	-	594	793	0	0	3	18
	MP	168	-	360	528	1	3	0	0
	NMP	30	-	59	89	0	0	0	0
	Totals	397	-	1013	1410	1	3	3	18
July 31 - August 3, 1987	SMP	-	176	379	555	0	0	-No Count-	
	MP	-	470	520	990	0	2	0	0
	NMP	-	136	135	271	0	0	0	0
	Totals	-	782	1034	1816	0	2	0	0
October 16-18, 1987	SMP	-	114	189	303	0	0	0	9
	MP	-	221	258	479	0	31	0	0
	NMP	-	111	91	202	0	0	0	0
	Totals	-	446	538	984	0	31	0	9

[1]SMP - "The Shack" to Mail Point (3.0 km of coastline).
MP - Mail Point area (0.5 km of coastline).
NMP - Mail Point to Seal Cove Point (4.0 km of coastline).

Table 2. Observed age class distributions for northern elephant seals within the study area at San Clemente Island during 1986 and 1987.

Trip Period Date	Unclassified	Subadult/Adult M	Subadult/Adult F	Subadult/Adult Unsexed	Yearling/ Juvenile	Pup M	Pup F	Pup ?
March 28-31, 1986		0	0	4	19	1	0	0
June 12-13, 1986[1]		0	0	0	0	0	0	0
July 25-28, 1986		0	0	0	1	0	0	0
September 12-15, 1986		0	2	0	0	0	0	0
December 22-23, 1986		-	-	-	-	-	-	-
March 17-18, 1987		0	1	0	2	0	1	0
July 31 - August 3, 1987		0	1	1	0	0	0	0
October 16-18, 1987	31	0	0	0	0	0	0	0

[1] - A northern elephant seal "non-pup" was seen at the Northwest Harbor Islet.

Table 3. Numbers of California Sea lion scats and spewings collected within the study area at San Clemente Island during 1986 and 1987.

Trip Period Date	Area of Collection[1]	NUMBER OF SCATS AND SPEWINGS COLLECTED: Fresh scats	Semi-fresh scats	Spewings	Totals
March 29-30, 1986	MP, SMP[2]	44	0	0	44
June 12, 1986	SMP	41	0	0	41
July 26-27, 1986	SMP, MP, NMP	13	15	0	28
September 12-14, 1986	MP, SMP	19	3	0	22
December 22-23, 1986	MP, SMP	3	3	3	9
March 16-17, 1987	MP, SMP	27	6	2	35
August 1-2, 1987	MP, SMP	53	0	0	53
October 17-18, 1987	MP, SMP	40	0	1	41
TOTALS		240	27	6	273

[1] SMP - "Arch Rock" to Mail Point (1.4 km of coastline)
MP - Mail Point Area (0.5 km of coastline)
NMP - Mail Point to Seal Cove Point (4.0 km of coastline)

[2] - A fresh northern elephant was also obtained.

Table 4. Positively identified prey found in 130 California sea lion scats and spewings collected within the study area at San Clemente Island during 1986. Data are presented for the number and percent frequency of occurrence (PFO) from all samples in which a prey item was recovered. Fourteen additional samples were not included since no prey remains were recovered.

PREY SPECIES		Numbers of Occurrences for Total Samples	PFO for Total Samples
Scientific Name	Common Name	N	%
Engraulis mordax	Northern anchovy	102	78.5
Merluccius productus	Pacific whiting	42	32.3
Loligo opalescens	Market squid	33	25.4
Sebastes spp.	Rockfish	14	10.8
Trachurus symmetricus	Jack mackerel	11	8.5
Scomber japonicus	Pacific mackerel	8	6.2
Pleuroncodes planipes	Pelagic red crab	7	5.4
Octopus spp.	Octopus	4	3.1
Onychoteuthis borealijaponicus	Squid	3	2.3
Abraliopsis spp.	Squid	3	2.3
Gonatus spp.	Squid	3	2.3
Seriphus politus	queenfish	2	1.5
Genyonemus lineatus	white croaker	2	1.5
Chromis punctipinnis	Blacksmith	2	1.5
Lycodes cortezianus	bigfin eelpout	1	0.8
Glyptocephalus zachirus	rex sole	1	0.8
Chilara taylori	spotted cusk-eel	1	0.8
Stenobrachius leucopsarus	northern lampfish	1	0.8
Synodus lucioceps	California lizardfish	1	0.8
Cololabis saira	Pacific saury	1	0.8
	Unid. cephalopods	6	4.6
	Unid. fishes	6	4.6
	Unid. fish teeth	3	2.3
	Unid. crustacean parts	1	0.8
TOTAL NUMBER OF OCCURRENCES		258	

Table 5. Summary of marine mammal strandings observed at San Clemente Island during 1986 and 1987. Unless noted, all strandings were California sea lions.

SEAL COVE POINT TO THE SHACK				
Trip Period Dates	1985 Pups	1986 Pups	1987 Pups	Non-Pups
March 28-31, 1986[1]	0	-	-	3
June 12-13, 1986[2]	0	0	-	0
July 25-28, 1986	0	1	-	3
September 12-15, 1986	2	3	-	0
December 22-23, 1986	0	1	-	0
March 17-18, 1987	0	1	-	0
July 31 - August 3, 1987	0	0	5	7
October 16-18, 1987	0	0	3	3
TOTALS	2	6	8	16

[1] A beaked whale (Ziphius spp.) was salvaged outside the study area at the northwest tip of the island on March 31, 1986.

[2] Incomplete count for area or trip

Table 6. Numbers, mean weights, lengths, and girths for California sea lion pups captured and tagged at San Clemente Island during September 13-14, 1986.

Sex	Number of Tagged 1986 Pups	Mean Weight of 1986 Pups	SD
Males	49 (47%)	23.2 kg (N=49)	2.8
Females	56 (53%)	19.6 kg (N=56)	2.6
Both	105	21.3 kg (N=105)	3.3

	Males	Females	Combined
Mean Length (CM)	100.0	94.8	97.2
SD	4.6	4.2	5.1
Range (CM)	83 - 108	86 - 105	83 - 108
Sample size	45	52	97

	Males	Females	Combined
Mean Girth (CM)	69.9	65.2	66.9
SD	4.1	3.5	4.2
Range (CM)	54 - 81	52 - 74	52 - 81
Sample size	45	52	97

Table 7. Unique resights of San Clemente Island-tagged California sea lions and within the study area at San Clemente Island, by month and cohort, during 1986 and 1987.

Date Resights Obtained	1981-1982 Pups		1983 Pups		1984 Pups		1985 Pups		1986 Pups	
	Tags Read	Tags Unread	Tags Read	Tags Unread	Tags Read	Tags Unread	Tags Read	Tags Unread	Tags Read	Tags Unread
March 28-31, 1986	0	1	1	1	5	2	19	11	-	-
June 12-13, 1986	0	0	0	0	2	1	4	3	-	-
July 25-28, 1986	0	0	1	0	3	1	5	3	-	-
Sept. 12-15, 1986	0	0	0	0	0	0	3	3	-	-
March 17-18, 1987	0	0	0	0	2	0	2	0	9	3
July 31-Aug 3, 1987	0	0	3	0	1	0	1	0	1	5
Oct. 16-18, 1987	1	1	1[1]	0	6	1	8	0	2	0
Totals	1	2	6[1]	1	19	5	42	20	12	8

[1] Tag number 278 was found not associated with a carcass.

Table 8. Resights of live tagged pinnipeds, from other areas, observed within the study area at San Clemente Island during 1986 and 1987.

Tag Resight Date	Tag Number, Color, Type and Placement	Observed Age	Species	Area Where Animal Was Tagged
July 26, 1986	Z 24 Red Riese Left front flipper	Juvenile	Zalophus californianus	San Nicolas Island
September 14, 1986	Radio transmitter was found which reportedly had been on a San Nicolas Island animal		Zalophus californianus	San Nicolas Island
March 16, 1987	Z254 Red Riese Right front flipper Red Reise Left front flipper		Zalophus californianus	San Nicolas Island
March 16, 1987	Red Riese Right front flipper Red Reise Left front flipper	Yearling or Juvenile	Zalophus californianus	San Nicolas Island
August 1, 1987	Z 22 Red Riese Right front flipper Z 22 Red Reise Left front flipper		Zalophus californianus	San Nicolas Island
August 1, 1987	Z 33 Red Riese Left front flipper		Zalophus californianus	San Nicolas Island
August 1, 1987	360 Blue Riese Right front flipper		Zalophus californianus	Santa Barbara Island
August 1, 1987	M 11 Red Riese Right front flipper M 11 Red Reise Left front flipper		Zalophus californianus	San Nicolas Island
August 1, 1987	I 35 Red Riese Right front flipper I 35 Red Reise Left front flipper		Zalophus californianus	San Nicolas Island
October 16, 1987	J 84 Red Riese Right front flipper J 84 Red Reise Left front flipper		Zalophus californianus	San Nicolas Island

[1] Tag numbers were either illegible or not visible.

Table 8. continued.

Tag Resight Date	Tag Number, Color, Type and Placement	Observed Age	Species	Area Where Animal Was Tagged
October 16, 1987	Red Riese Right front flipper Red Reise Left front flipper		Zalophus californianus	San Nicolas Island
October 16, 1987	Red Reise Right rear flipper		Mirounga angustirostris	San Nicolas Island

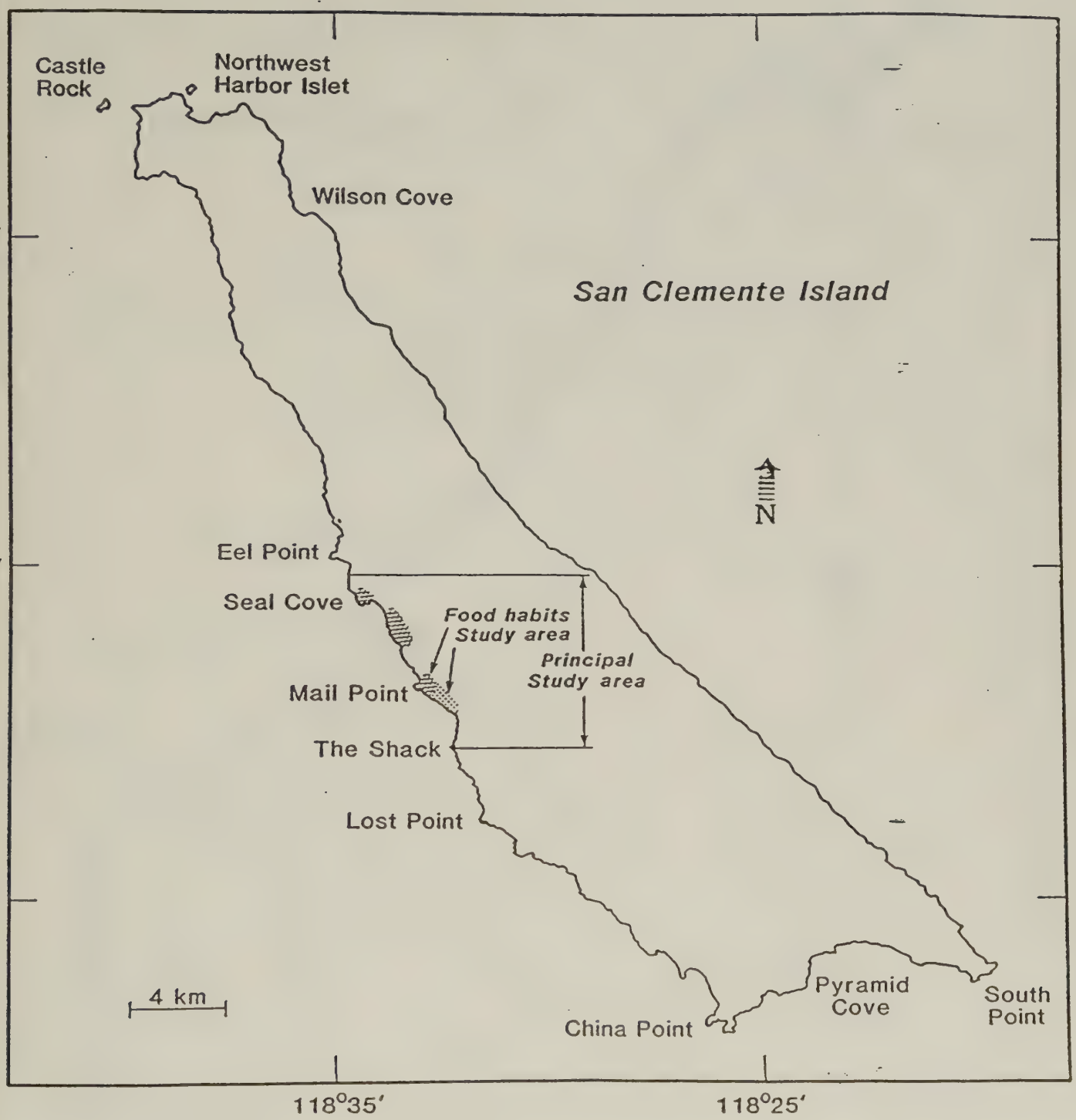

Figure 1. Map of San Clemente Island showing the study area. Observed breeding areas are indicated by crosshatch. Areas used primarily as haulouts are indicated with stipple.

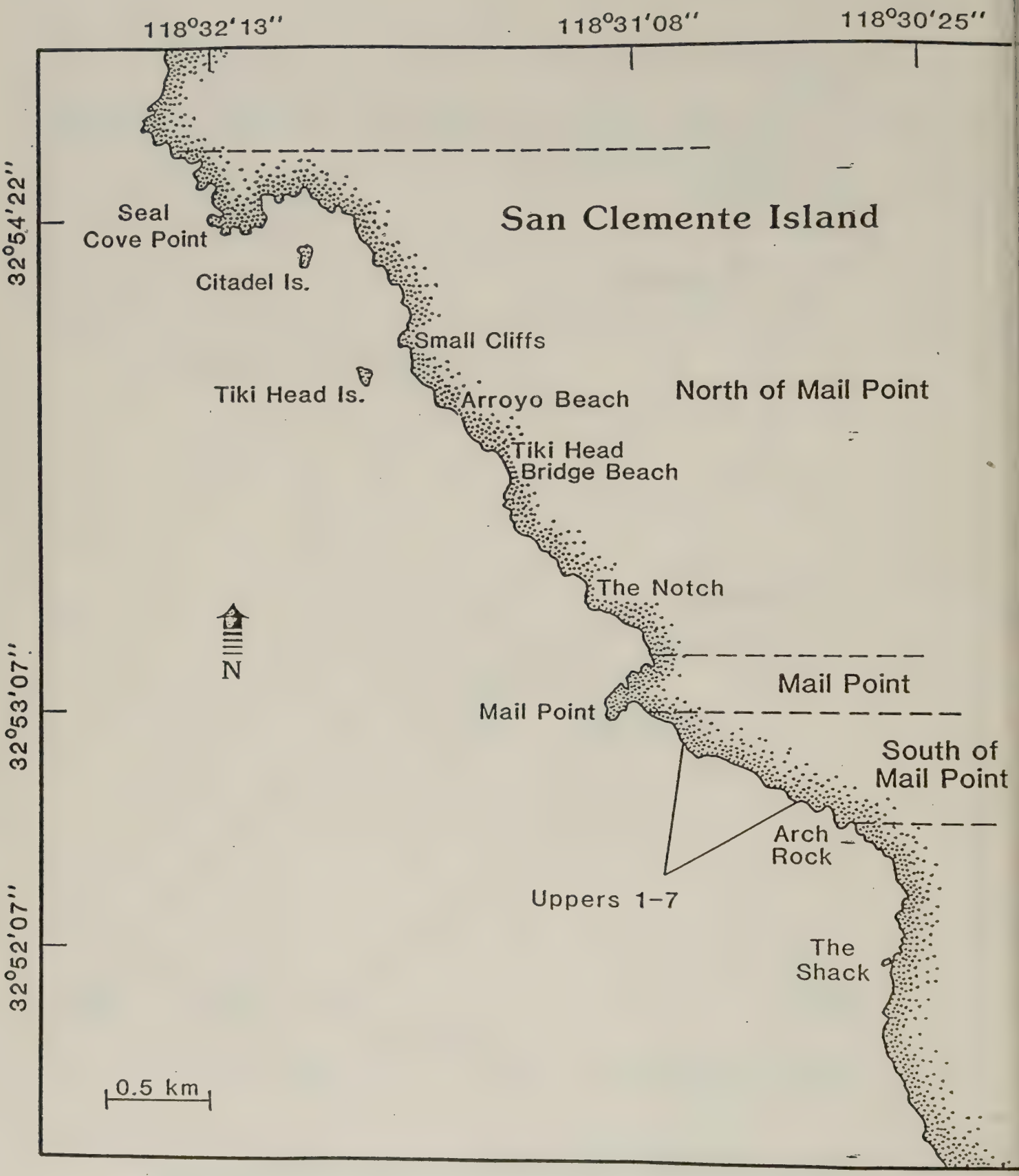

Figure 2. San Clemente Island study area showing the three sub-areas where pinnipeds were studied.

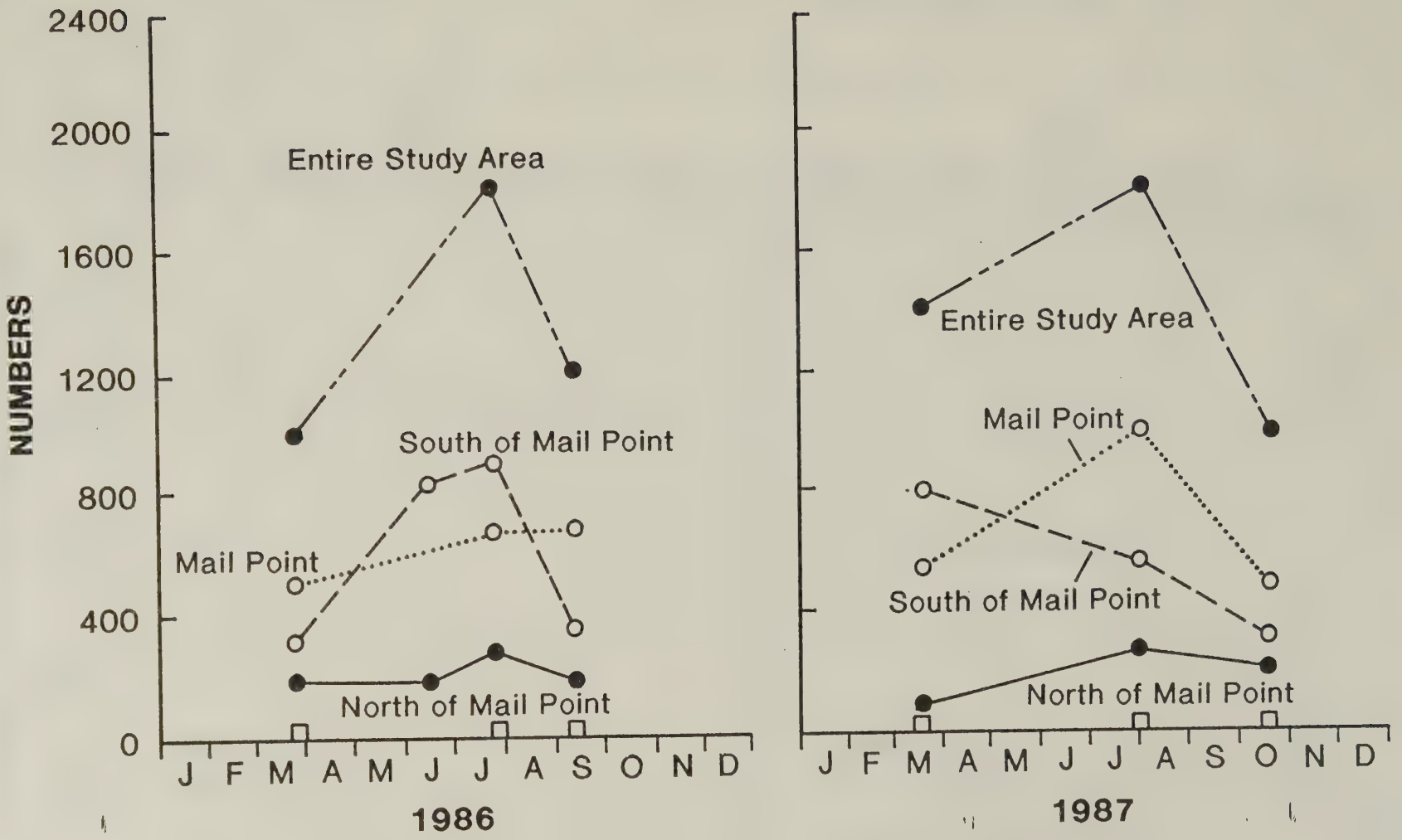

Figure 3. Numbers of California sea lions counted at San Clemente Island for 1986 and 1987.

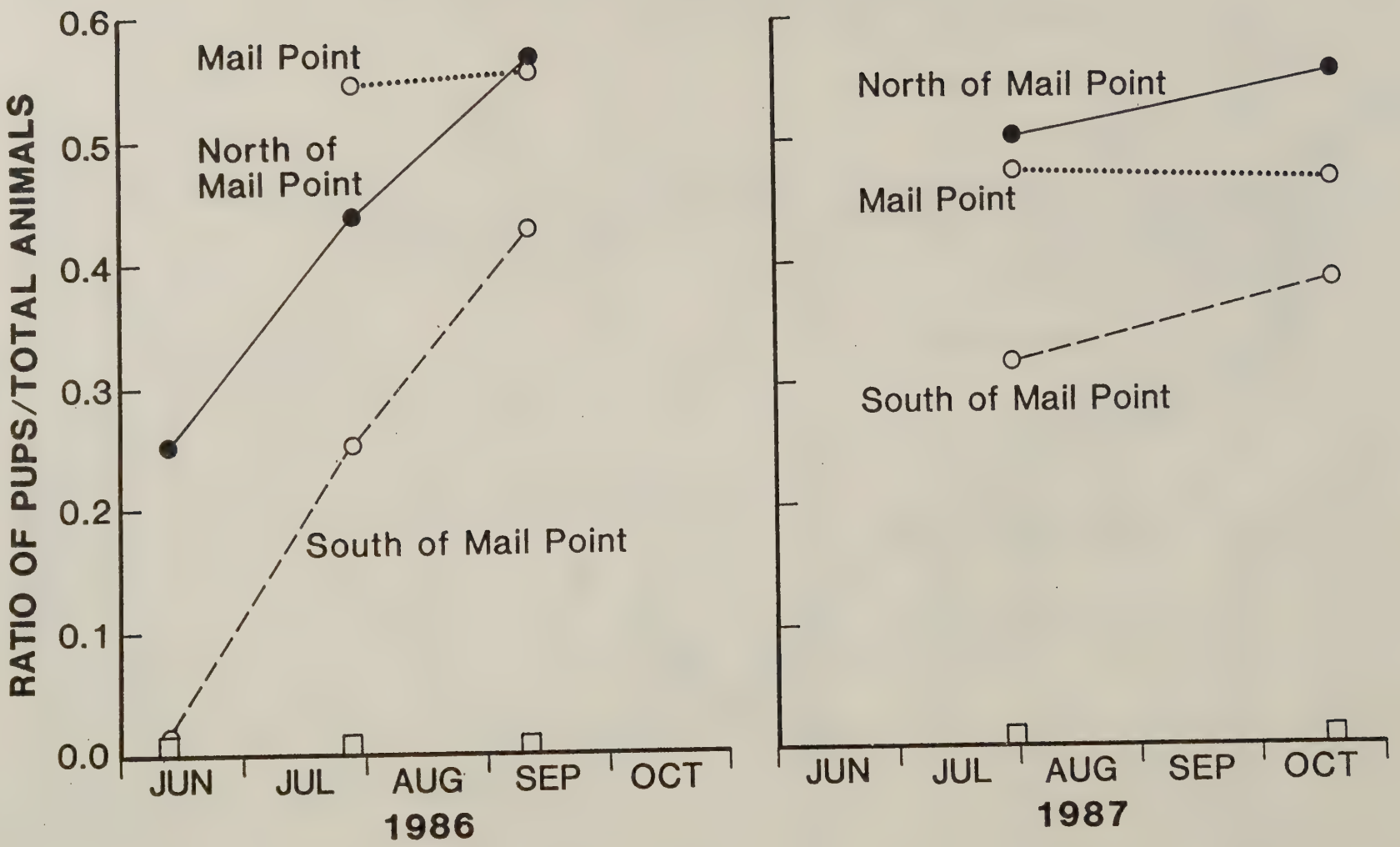

Figure 4. Ratios of California sea lion pup counts to total counts, by area, at San Clemente Island for 1986 and 1987.

Appendix 1. Dead strandings of marine mammals salvaged on San Clemente Island during 1986 and 1987.

DATE	SPECIMEN NUMBER	SPECIES[1]	LATITUDE	LONGITUDE	SEX[2]	AGE CLASS[3]	TAGS PRESENT	SPECIMEN PARTS COLLECTED TEETH —?	SKULL ?
830226		Z	32 52'59''N	118 30'55''W	U	A			
860328	JBW0110	Z	32 53'22''N	118 31'12''W	M	SA			
860329	JBW0111	Z	32 53'10''N	118 31'07''W	F	SA			
860329		Z	32 52'51''N	118 30'36''W	M	SA			
860331	JBW0112	BW	33 00'42''N	118 36'24''W	U	U			
860726	CWO0948	Z	32 53'55''N	118 31'38''W	U	J			
860726	CWO0949	Z	32 53'55''N	118 31'38''W	U	J			
860726	CWO0950	Z	32 53'31''N	118 31'21''W	U	SA			
860726	CWO0951	Z	32 52'43''N	118 30'40''W	U	P86			
860912	CWO0952	Z	32 53'10''N	118 31'07''W	U	P85			
860912	CWO0953	Z	32 53'07''N	118 31'04''W	U	P86			
860912	CWO0954	Z	32 53'07''N	118 31'04''W	U	P86			
860912	CWO0955	Z	32 53'00''N	118 30'57''W	U	P85			
860912	CWO0956	Z	32 52'43''N	118 30'40''W	U	P86			
861222	CWO0957	Z	32 52'57''N	118 30'48''W	U	P86			
870316		Z	32 52'57''N	118 30'48''W	U	P86			
870731		Z	32 54'05''N	118 31'42''W	U	SA/A			
870731		Z	32 54'05''N	118 31'42''W	U	SA/A			
870731		Z	32 54'05''N	118 31'42''W	U	SA/A			
870731		Z	32 54'05''N	118 31'42''W	U	SA/A			
870731		Z	32 54'05''N	118 31'42''W	U	A			
870731		Z	32 53'50''N	118 31'33''W	U	A			
870801		Z	32 53'07''N	118 31'04''W	U	P87			
870801		Z	32 53'07''N	118 31'04''W	U	P87			
870801		Z	32 53'07''N	118 31'04''W	U	P87			
870801		Z	32 53'07''N	118 31'04''W	U	P87			
870801		Z	32 52'43''N	118 30'40''W	U	P87			
870801		Z	32 52'51''N	118 30'36''W	U	A			
871017		Z	32 53'10''N	118 31'04''W	F	A			
871017		Z	32 53'07''N	118 31'04''W	U	P87			
871017		Z	32 53'07''N	118 31'04''W	U	P87			
871017		Z	32 53'07''N	118 31'07''W	U	P87			
871018		Z	32 53'22''N	118 31'12''W	U	A			
871018		Z	32 53'22''N	118 31'12''W	U	J			

[1] SPECIES: BW=Beaked whale (*Ziphius spp.*)
Z=California sea lion (*Zalophus californianus*)

[2] SEX: M=Male; F=Female; U=Unknown

[3] AGE CLASS: P85=Pup of 1985; P86=Pup of 1986; P87=Pup of 1987;
Y=Yearling; J=Juvenile;
SA=Subadult; A=Adult; U=Unknown; PRE=Premature

Appendix 2. White tags placed on northern elephant seals, Mirounga augustirostris, at San Clemente Island during 1986 and 1987.

ANIMAL ID	DATE (YR/MO/DAY)	LOCAL TIME	LEFT FLIPPER TAG NUMBER	RIGHT FLIPPER TAG NUMBER	SEX	AGE CLASS P=PUP Y=YEARLING J=JUVENILE S=SUBADULT A=ADULT	ANIMAL CONDITION G=GOOD F=FAIR P=POOR
658	86/03/29	0930	658	658	M	P	G
659	86/03/29	1125	659			Y	G
660	86/03/29	1130	660			Y	G
661	86/03/29	1140		661		Y	G
662	86/03/30	0815	662		M	Y	G
772	87/03/17	1000	772		F	Y	G
773	87/03/17	1030	773	773	F	P	G
774	87/03/17	1500		774	M	Y	G

Appendix 3. White tags placed on California sea lions, Zalophus californianus, at San Clemente Island during 1986. All tags were Dalton Riese.

ANIMAL ID	DATE (YR/MO/DAY)	LOCAL TIME	LEFT FLIPPER TAG NUMBER	RIGHT FLIPPER TAG NUMBER	SEX	AGE CLASS P=PUP Y=YEARLING J=JUVENILE S=SUBADULT A=ADULT	ANIMAL CONDITION G=GOOD F=FAIR P=POOR	ANIMAL WEIGHT (KG)
664	86/09/13	1015	664	664	F	P	G	19.5
665	86/09/13	1015	665	665	M	P	G	22.6
667	86/09/13	1015	667	667	M	P	G	25.4
668	86/09/13	1015	668	668	M	P	G	25.8
669	86/09/13	1015		669	F	P	G	20.4
670	86/09/13	1015	670	670	F	P	F	12.2
671	86/09/13	1015	671	671	M	P	G	19.5
672	86/09/13	1015	672	672	M	P	G	24.5
673	86/09/13	1015	673	673	F	P	G	16.3
674	86/09/13	1015	674	674	M	P	G	22.6
675	86/09/13	1055	675	675	F	P	G	21.3
676	86/09/13	1058	676	676	F	P	G	19.9
677	86/09/13	1106	677	677	M	P	G	23.6
678	86/09/13	1112	678	678	F	P	G	19.5
679	86/09/13	1112	679	679	F	P	G	19.9
680	86/09/13	1112	680	680	F	P	F	10.9
681	86/09/13	1200	681	681	F	P	G	19.5
682	86/09/13	1200	682	682	F	P	G	19.9
683	86/09/13	1200	683	683	M	P	G	23.6
684	86/09/13	1200	684	684	F	P	F	14.5
685	86/09/13	1200	685	685	M	P	G	26.3
686	86/09/13	1200	686	686	M	P	G	25.8
687	86/09/13	1200	687	687	F	P	G	19.0
688	86/09/13	1200	688	688	M	P	G	24.9
689	86/09/13	1200	689	689	M	P	G	27.6
690	86/09/13	1200	690	690	M	P	G	21.7
691	86/09/13	1249	691	691	F	P	G	17.2
692	86/09/13	1249	692	692	F	P	G	21.3
693	86/09/13	1249	693	693	F	P	G	18.1
694	86/09/13	1249	694	694	F	P	G	21.3
695	86/09/13	1249	695	695	F	P	G	17.2
696	86/09/13	1249	696	696	M	P	G	22.6
697	86/09/13	1249	697	697	F	P	G	22.6
698	86/09/13	1249	698	698	M	P	G	23.6
699	86/09/13	1249	699	699	F	P	G	23.1
700	86/09/13	1249	700	700	M	P	G	22.2
701	86/09/13	1249	701	701	F	P	G	21.7
702	86/09/13	1249	702	702	F	P	G	16.8
703	86/09/13	1249	703	703	M	P	G	26.7
704	86/09/13	1249	704	704	F	P	G	23.1
705	86/09/13	1249	705	705	M	P	G	20.8
706	86/09/13	1249	706	706	M	P	G	23.6
707	86/09/13	1249	707	707	M	P	G	26.3

Appendix 3. Continued.

ANIMAL ID	DATE (YR/MO/DAY)	LOCAL TIME	LEFT FLIPPER TAG NUMBER	RIGHT FLIPPER TAG NUMBER	SEX	AGE CLASS P=PUP Y=YEARLING J=JUVENILE S=SUBADULT A=ADULT	ANIMAL CONDITION G=GOOD F=FAIR P=POOR	ANIMAL WEIGHT (KG)
708	86/09/13	1249	708	708	M	P	G	25.4
709	86/09/13	1249	709	709	M	P	G	21.7
710	86/09/13	1249	710	710	F	P	G	19.9
711	86/09/13	1249	711	711	F	P	G	22.2
712	86/09/13	1249	712	712	F	P	G	16.8
713	86/09/13	1249	713	713	F	P	G	19.9
714	86/09/13	1249	714	714	F	P	G	19.9
715	86/09/13	1249	715	715	M	P	G	23.1
716	86/09/13	1249	716	716	F	P	G	16.3
717	86/09/13	1420	717	717	M	P	G	23.1
718	86/09/13	1420	718	718	F	P	G	19.9
719	86/09/13	1420	719	719	M	P	G	26.3
720	86/09/13	1420	720	720	M	P	G	21.7
721	86/09/13	1420	721	721	M	P	G	21.3
722	86/09/13	1420	722	722	F	P	G	21.7
723	86/09/13	1420	723	723	M	P	G	21.3
724	86/09/13	1420	724	724	M	P	G	25.4
725	86/09/13	1420	725	725	F	P	G	21.3
726	86/09/13	1420	726	726	F	P	G	19.0
727	86/09/14	938	727	727	F	P	G	19.0
728	86/09/14	938	728	728	F	P	G	18.6
729	86/09/14	938	729	729	M	P	G	21.3
730	86/09/14	938	730	730	M	P	G	22.2
731	86/09/14	938	731	731	M	P	F	10.9
732	86/09/14	938	732	732	F	P	G	21.3
733	86/09/14	938	733	733	F	P	G	22.6
734	86/09/14	938	734	734	F	P	G	17.7
735	86/09/14	938	735	735	M	P	G	24.0
736	86/09/14	1019	736	736	F	P	G	20.4
737	86/09/14	1051	737	737	F	P	G	20.8
738	86/09/14	1051	738	738	M	P	G	24.5
739	86/09/14	1051	739	739	M	P	G	25.8
740	86/09/14	1051	740	740	M	P	G	27.2
741	86/09/14	1051	741	741	M	P	G	21.3
742	86/09/14	1051	742	742	F	P	G	23.6
743	86/09/14	1051	743	743	M	P	G	21.3
744	86/09/14	1051	744	744	M	P	G	19.9
745	86/09/14	1051	745	745	M	P	G	24.0
746	86/09/14	1051	746	746	M	P	G	24.9
747	86/09/14	1051	747	747	M	P	G	24.9
748	86/09/14	1051	748	748	F	P	G	18.6
749	86/09/14	1051	749	749	F	P	G	20.8
750	86/09/14	1051	750	750	M	P	G	25.4
751	86/09/14	1051	751	751	F	P	G	20.8

Appendix 3. Continued.

ANIMAL ID	DATE (YR/MO/DAY)	LOCAL TIME	LEFT FLIPPER TAG NUMBER	RIGHT FLIPPER TAG NUMBER	SEX	AGE CLASS P=PUP Y=YEARLING J=JUVENILE S=SUBADULT A=ADULT	ANIMAL CONDITION G=GOOD F=FAIR P=POOR	ANIMAL WEIGHT (KG)
752	86/09/14	1051	752	752	F	P	G	20.8
753	86/09/14	1140	753	753	M	P	G	18.6
754	86/09/14	1140	754	754	F	P	G	16.8
755	86/09/14	1140	755	755	M	P	G	24.9
756	86/09/14	1140	756	756	F	P	G	21.3
757	86/09/14	1320	757	757	M	P	G	24.5
758	86/09/14	1320	758	758	F	P	G	25.8
759	86/09/14	1320	759	759	M	P	G	24.5
760	86/09/14	1320	760	760	F	P	G	17.7
761	86/09/14	1320	761	761	F	P	F	17.7
762	86/09/14	1320	762	762	F	P	G	19.5
763	86/09/14	1320	763	763	F	P	G	20.8
764	86/09/14	1320	764	764	M	P	G	21.3
765	86/09/14	1320	765	765	M	P	G	21.3
766	86/09/14	1320	766	766	F	P	G	22.2
767	86/09/14	1320	767	767	M	P	G	23.6
768	86/09/14	1320	768	768	F	P	G	17.7
769	86/09/14	1430	769	769	M	P	G	19.9
770	86/09/14	1430	770	770	F	P	G	20.8
771	86/09/14	1430	671	671	F	P	G	18.6